

2001 Annual Report

Kentucky Transportation Center

College of Engineering • University of Kentucky

Kentucky Transportation Center

Our Mission

We provide services to the transportation community through research, technology transfer and education.

We create and participate in partnerships to promote safe and effective transportation systems.

We Value...

Teamwork

Listening and communicating along with courtesy and respect for others.

Honesty and ethical behavior

Delivering the highest quality products and services.

Continuous improvement in all that we do.



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Kentucky Transportation Center Annual Report 2001

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UK Transportation Research: Twenty Years in Motion!

This year marks the 20th year that the University of Kentucky has been responsible for Kentucky's highway transportation research program. The Kentucky Transportation Center, in the College of Engineering, has seen rapid funding growth serving the transportation research needs of the Commonwealth. Also, the Center is becoming nationally recognized for its research and technology transfer capabilities.

1981-1986

- Commonwealth of Kentucky (Highway Department) transferred its transportation research program and facilities to the University of Kentucky (UK).
- UK Transportation Center was designated a Technology Transfer Center by the Federal Highway Administration.
- Kentucky General Assembly began providing funds for Technology Transfer.



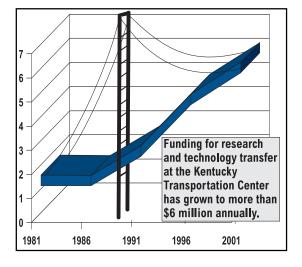
- UK was instrumental in forming the Southeastern Consortium of University Transportation Centers.
- UK began receiving FHWA funds through the consortium for graduate fellowships in transportation.
- Center chosen to lead federally funded, multi-state, I-75 corridor research project for the electronic screening of trucks.

1991-1996

- Center received the ITS America's Achievement Award for research in the area of commercial vehicle operations.
- A program was established to study and research the environmental concerns of highway development.
- Studies of the Traffic and Safety Program on the effectiveness of Lexington's seat belt ordinance led to a statewide law.

1996-2001

- Center established programs for Intelligent Transportation Systems and Policy and Systems Analysis
 research.
- New laboratory facilities for pavement, geotechnical, and structures research were opened in the Raymond Building.
- World's longest fiber-reinforced polymer (FRP) bridge was tested and installed in Bath County, Kentucky, by the Center.
- Center nationally recognized for its work in Context-Sensitive Design by receiving a major funding award.



Paul Toussaint, Director Kentucky Transportation Center

Message From the Director Kentucky Transportation Center

If research in transportation is to have value, it must solve a problem or create an opportunity for improvement. The Center at UK spearheads transportation research for the Kentucky Transportation Cabinet and carries out a research program having regional and even national impact.

As a result of research conducted at the Center, we might find ways to locate the route of a new road that better protects the environment as well as find workable methods to partner with the public in designing a roadway to fit in with their community. We might engineer an improved drainage system that makes a road last considerably longer. We might develop

a longer-lasting, bridge paint-coating method or find a new durable composite material for a bridge structure and deck. During the past few years we have conducted research that has, in fact, done these things (and more)—creating considerable value. Occasionally, we can't find a workable solution, but our track record is good and we strive to exceed expectation. The investment made in the Center's research allows Kentucky's transportation dollars to go further, last longer and represent true value for Kentuckians.

In addition to research, we take seriously our role to transfer technology through information, training and technical assistance to those in state and local governments as well as to provide educational experiences and opportunities for students at UK.

Message From the Kentucky Secretary of Transportation

Each year we review and discuss various transportation problems and opportunities that we feel merit further scrutiny. Kentucky Transportation Cabinet professionals collaborate with University of Kentucky researchers throughout the year to ensure that our research efforts are appropriately addressed.

We have formed a unique research-client relationship with the Kentucky Transportation Center. Various states and other countries have inquired as to the operation and success of our joint endeavor.

Some of the research is done as quick response studies that provide information or recommendations in weeks. Other research must be accomplished over longer periods of time,

James C. Codell III Kentucky Transportation Secretary

typically 18 or 24 months. The ongoing working relationship we have established with the Center assures us that we receive a high value from our research investment.

I commend the employees of the Kentucky Transportation Cabinet, the University of Kentucky research personnel and the staff of the Kentucky Transportation Center for developing a program that provides very meaningful results and is recognized both nationally and internationally.

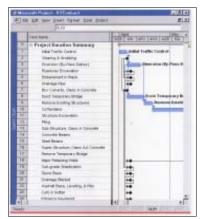
Value of Construction Engineering and Management Research

Major 2001 Projects

- Kentucky Contract Time Determination
- Quality-Based Contractor
- Prequalification
- Contractor Performed Quality Control
- Paris Pike Project Performance



Assuring quality control



Project management tool

About their value...

A computerized system (KY-CTDS) was developed to assist the Kentucky Transportation Cabinet/Districts in setting allowable contract time durations for its construction projects.

A quality-based contractor project performance evaluation system was developed that can be used in the annual contractor prequalification process. A performance evaluation process also was developed for contractors to evaluate the performance of the Cabinet on projects.

An evaluation is underway of the current efforts to transfer quality control responsibilities from the Cabinet to the contractors. Efforts will continue on developing an implementation plan for future contractor quality control activities.

Results of the unique development/ construction process on the environmentally sensitive Paris Pike project is being reviewed and compared to those achieved on similar but traditionally contracted construction projects.

Value of Environmental Analysis Research

Major 2001 Projects

- Addressing Public Concerns in Project Development
- Case Studies of 4f Litigation and Rulings
- Variations that Impact Environmental Commitments
- Assessment and Modeling of Stream Mitigation Procedures
- Experimental Painting of Bridges
- Environmental Impacts of Bridge-Cleaning Operations



Citizen involvement



Integrating overpasses with the environment



Public land and roadways

About their value...

Improvements in highway project development can facilitate project delivery and alleviate public concerns. One Environmental Analysis study has provided the Kentucky Transportation Cabinet with a coherent approach to facilitate public interaction with highway projects.

Another study addresses federal regulations about roads interacting with public (4f) lands. It will provide officials with guidance to properly implement roads in those publicly sensitive locations. Another study is intended to eliminate variations in the project development process that preclude compliance with environmental commitments.

Center researchers are working with the Highway Department's Paint Team to analyze wastewaters generated during painting operations to ensure proper disposal. Program researchers also are monitoring experimental painting projects and are conducting laboratory evaluations of new coatings systems proposed for future use on bridges.

Value of Geotechnical Research

Major 2001 Projects

- Development of a Statewide Landslide Inventory Program
- Reduction of Stresses on Buried Rigid Highway Structures using the Imperfect Ditch Method and Expanded Polystyrene (Geofoam)
- Corrosion Evaluation of Mechanically Reinforced Walls
- Bearing Capacity Analysis and Design of Base Material Reinforced with Geo-fabrics
- Long-Term Benefits of Stabilizing Highway Subgrades
- Highway Rock Slope Management Program
- Geotechnical Database of Kentucky
- Resilient Modulus of Kentucky Soils



Hazardous rock slope



Highway landslide failure



Subgrade chemical stabilization

About their value...

Excavation represents a large portion of the total cost of building highways. Consequently, research into new ways of building rock slopes, embankments, geotechnical structures, and subgrades is vital.

Based on research performed by the Center, the Kentucky Transportation Cabinet began a subgrade stabilization program in 1986. In support of this program, several in-situ strength tests were recently performed at 18 sites.

A user-friendly database has been developed to track some 1,200 landslides and 1,900 rockfall sites on Kentucky highways. This database provides a tool for managing funds to repair the sites. The database also contains several thousand soil and rock engineering records.

Expanded polystyrene (EPS), or geofoam, is an ultra lightweight material that has the potential to save millions of dollars when used to repair landslides. Research has shown this to be a much needed stress reduction material.

Value of Intelligent Transportation Systems (ITS) Research

Major 2001 Projects

- Development of Kentucky's ITS Business Plan
- Development of Kentucky's Statewide ITS Architecture
- Guidelines for the Design and Use of Changeable Message Signs
- Evaluation of 220 MHz Frequencies for ITS Experimentation
- Deployment and Evaluation of a Remote Monitoring System for Commercial Vehicle Enforcement
- Commercial Vehicle Mainline Screening Enhancements



Traffic operations center



Dynamic message sign



Electronic screening of trucks

About their value...

Intelligent Transportation Systems (ITS) refers to the application of advanced technologies to improve the safety and efficiency of surface transportation. Since the early 1990s, the State and the Center have enjoyed positions of national prominence in ITS.

The Center's ITS research included the development of Kentucky's strategic plan for ITS deployment. The plan's goals have been translated into specific project recommendations in the ITS Business Plan.

ITS technologies require integrated deployment, ensuring intrastate and interstate compatibility. The Center has supported the achievement of this objective through the development of statewide ITS Architecture.

ITS projects in 2001 support a wide range of applications, from commercial vehicle operations to traveler information systems. All users of Kentucky's highways will benefit from safer and faster travel through the wise use of ITS technologies.

Value of Pavements and Materials Research

Major 2001 Projects

- Compaction at Construction Joints in Asphalt Pavements
- Development of a Permeability Test for Asphalt Pavements
- Definition of Road User Costs for Construction Contracts
- Application of Ground Penetrating Radar for Highway Construction
- Study of Issues Related to Pavement Warranties and Life Cycle Costs



Notched wedge joints



Permeability test device



Ground penetrating radar

About their value...

Lack of compaction (density) at construction joints on asphalt pavements is a major cause of premature failure. Increased distresses such as raveling, cracking, and potholes are the result. A current study is determining new and more effective ways of achieving the desired density.

Water in asphalt pavement layers can damage those layers by emulsifying the asphalt binder, causing a phenomenon known as "stripping." It is important to know the permeability of asphalt layers and to design asphalt mixtures that are less permeable. The Center is developing a method to measure the permeability of asphalt layers in the field.

Ground penetrating radar is new technology that is being used to measure the quality and thickness of in-place asphalt layers. It also can estimate the quality of concrete on old highway bridge decks to assist the engineer in determining rehabilitation strategies.

Value of Policy and Systems Analysis Research

Major 2001 Projects

- Governor's Smart Growth Initiative
- Kentucky Abandoned Rail Inventory
- Commercial Vehicle Information Systems and Networks Outreach
- Transportation Systems Management Certificate Program
- Kentucky Highway User Survey
- Federal Motor Carrier Safety Administration Workshop Series
- Visualization and Facilitation Guides for States, Consultants and Citizens



Motor carrier outreach materials



Public involvement research



Locating abandoned rail beds

About their value...

The goal of the Abandoned Rail Inventory Project is to inventory the location and condition of all abandoned railroad lines in Kentucky. Each line is rated based on its condition, its connectivity to centers of population, its connection to other trail and road networks, and its potential for recreational and transportation uses. An interactive, web-accessible GIS will be the end result of this research—available to interested local governments or community groups for future rails-to-trails projects or local history.

The Policy and Systems Analysis Program team is at the national forefront of *Structured Public Involvement* research, developing and applying advanced methodologies to improve public satisfaction with transportation infrastructure projects. Working cooperatively with stakeholders to integrate advanced technologies, Center researchers combine facilitation with multicriteria decision tools and computer visualizations into structured, coherent public involvement processes.

Value of Structures Research

Major 2001 Projects

- Seismic Evaluation of Bridges on I-24
- Post Earthquake Investigation Training
- Testing and Modeling of the Maysville Bridge
- Evaluation of the Roebling Bridge
- Barge Impact Loading on Bridges
- Carbon Rebars in Bridge Decks



Seismic research bridge



Maysville cable-stayed bridge

About their value...

Structures research focuses primarily on seismic evaluation of bridges in Western Kentucky. Over 500 bridges on and over I-24 and the Western Kentucky Parkways are under study to determine their capability of resisting projected earthquakes. When required, retrofit measures will be proposed for bridges to insure their survivability during a seismic event. In addition, post-earthquake investigation training will be offered to engineers throughout the state.

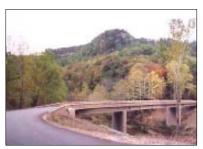
Research also has been carried out to evaluate and deploy advanced fiber reinforced polymer (FRP) composites, especially in the area of bridge deck reinforcement and strengthening of existing structures. FRP components will be one of the construction materials in the 21st Century.

Structures research leads to safer bridges in the Commonwealth and the nation, and to highly cost-effective investments of public funds.

Value of Traffic and Safety Research

Major 2001 Projects

- Improving Highway Crash Management Response
- Safety Implications of Design Exceptions
- Identification of High-Crash Corridors
- Evaluation of Graduated Driver Licensing Program
- Safety Belt Usage Surveys
- Analysis of Traffic Growth Rates



Context-sensitive design



Highway crash management



About their value...

The Traffic and Safety Research Program focuses on various highway safety features and traffic control devices. Analyses and evaluations are conducted either at specific high-crash sites, corridors, or on a statewide basis for the purpose of identifying countermeasures.

Here are some specific examples of traffic and safety research which have been of significant benefit: guidelines in highway crash site management via a checklist to help agencies implement a simplified, coordinated effort; exceptions in design used to achieve contextsensitive highway design; simplified procedures developed to identify high-crash corridors and countermeasures within each highway district; evaluations of the graduated driver licensing concept showing reductions in crashes and injuries for teenage drivers; safety belt usage surveys used to promote a statewide primary safety belt law; and traffic growth rate analysis used to develop county estimates of vehicle miles traveled to assess air quality.

Value of Technology Transfer

Major 2001 Projects

- Developed three new training programs
- Added 1,102 items to library holdings
- Presented 153 workshops attended by 5,216 transportation workers
- Issued quarterly newsletter
- Developed new training and information materials
- Assisted with development of International Symposium on Technology Transfer
- Assisted in delivery of SRC Environmental Workshop



Training workshop



On-site technical assistance



Library resource information

About their value...

The Technology Transfer Program assists transportation workers in delivering safe, efficient, transportation services by being a reliable source for information, training and technical assistance. The challenge of the 21st Century will be to develop training programs that address the needs of a dynamic workforce. For example, new legislation requiring skilled use of pesticides precipitated the development of two new courses on roadside vegetation management.

Kentucky's Program has historically played significant roles in delivering technology nationally and globally, most recently through an environmental workshop and an international symposium designed to enhance methods of transferring technology.

The Technology Transfer Program is Kentucky's Local Technical Assistance Program (LTAP) center, and receives funding from the Federal Highway Administration's LTAP program. A study of LTAP benefits shows that for every dollar spent by this federal program, benefits of eight dollars are received by local agencies.

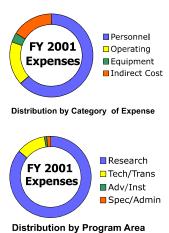
Value of Revenue Analysis

Studies conducted by the Center have indicated the need for the Kentucky Transportation Cabinet to focus more attention on fuel tax compliance. It has been estimated that tax evasion results in the loss of up to \$40 million in fuel tax revenue for Kentucky. The Center assists the Division of Road Fund Audits to assure the proper audit of road fund tax receipts. This staff group has no regulatory authority, but provides auditing assistance in the form of reviewing auditing procedures, designing tax return sampling procedures and carrying out statistical analyses to track trends while maintaining taxpayer confidentiality. It is assisting in the design of an audit database to relate data in various files including commercial vehicle registration and weigh station observation reports. During this past fiscal year, the unit provided information to yield more than \$350,000 in tax assessments.

Financial Snapshot

FY 2001 Expenditures*

Program Area	Research**	Technology Transfer	Advanced Institute	Special Administration	Total
Category of Expense:					
Personnel	3,355,249	320,020	50,000	54,255	3,779,524
Operating	894,161	402,023	5,067	35,156	1,336,407
Equipment	192,940	4,754	0	5,298	202,992
Indirect Costs	845,991	0	1,166	0	847,157
Total Program	5,288,341	726,797	56,233	94,709	6,166,080



^{*} Expenditure detail by subcategory of expense is available on request (1-800-432-0719 or locally at 257-4513 ext. 226).

^{**} The research/study program for Fiscal Year 2001 consisted of over 100 projects conducted for the following agencies: Kentucky Transportation Cabinet, Kentucky State Police, USDOT/FHWA, USDOT/FMCSA, NHTSA, Miami Valley Regional Planning Commission, and various private firms. Some work is done in cooperation with other universities including: Northwestern, University of Cincinnati, University of Louisville, UT/Knoxville, Georgia Tech, and Johns Hopkins; and also in partnership with private firms including TRW.

2001/2002 Kentucky Highway Research Projects

Construction Management

- Methods to Identify and Resolve Highway Constructibility Issues (#02-236)
- Impact of Incentive/Disincentive Construction Procedures on Quality (#02-243)

Environmental Analysis

3. Methods to Protect Water Quality from Highway Runoff (#02-237)

Geotechnology

- 4. Utilizing Geo-fabric for Reinforcing Highway Base Material (#02-238)
- 5. Performance of Reinforcing Strips in Retaining Walls (#02-239)

Intelligent Transportation Systems

- 6. Procurement Practices for New Technologies and Systems (#02-242)
- 7. Maintenance and Management Plan for High-Tech Components (#02-241)
- 8. 'Virtual' High-Tech Truck Weigh Station Prototype (#02-240)

Pavements and Materials

- 9. Aggregate Separation as a Prediction of Pavement Performance (#02-245)
- 10. Roadway Condition Rating Process (#02-256)
- 11. Non-Destructive Testing of Highway Subsurface Conditions (#02-244)

Policy and Systems Analysis

- 12. Public Engagement Process Research (#02-254)
- 13. Road Fund Tax Policy Update (#02-255)
- 14. Highway Customer Satisfaction Survey (#02-253)
- 15. Highway Cost Allocation Analysis Update (#02-252)

Structures

16. Seismic Evaluation of Parkway Bridges in Western Kentucky (#02-246)

Traffic and Safety

- 17. Prioritizing Safety Improvements for High Crash Locations (#02-250)
- Examination of Highway Lighting and Safety (#02-247)

Traffic and Safety (Continued)

- 19. Impact of Large Trucks on Interstate Highway Safety (#02-248)
- 20. Driver Opinions and Attitudes Related to Safety (#02-249)
- 21. Highway Access Management Guidelines (#02-251)

Research Reports Published During FY 2001

State Road Fund Revenue Collection Process: Differences and Opportunities for Improved Efficiency, Robert J. Eger III and Merl M. Hackbart, July 2001. (KTC-01-17/SPR99-192-1F)

Evaluation of Kentucky's Click or Ticket Campaign, Kenneth R. Agent and Eric Green, August 2001. (KTC-01-18/KSP1-01-1I)

Development and Proposed Implementation of a Field Permeability Test and Asphalt Concrete and Aggregate Base, David B. Schultz Jr., John Fleckenstein, and David Allen, July 2001. (KTC-01-19/SPR216-00-1F)

Kentucky Highway User Survey 2000, Ronald E. Longley, July 2001. (KTC-01-20/PSA-01-1F)

2001 Safety Belt Usage Survey in Kentucky, Kenneth R. Agent and Eric Green, August 2001. (KTC-01-21/KSP1-01-2F)

Development of Concrete AC/QA Specifications for Highway Construction in Kentucky, Kamyar C. Mahboub and Donn E. Hancher, July 2001. (KTC-01-22/SPR187-97-1F)

Intelligent Transportation Systems Business Plan, Jennifer Walton, Monica Barrett, Joe Crabtree and Jerry Pigman, August 2001. (KTC-01-23/SPR188-98-1F)

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Anna Dale Pyles
Principal Engineer
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Buddy Smith McCracken County Project Engineer and Advisor

Sandy Lee Watkins County Judge/Executive Henderson County

Locations of Kentucky Transportation Center staff



Raymond Building
University of Kentucky, Lexington

Whalen Building University of Kentucky, Lexington





Waller Avenue Building Lexington

The Kentucky Transportation Center is among the top three sponsored project award recipients for the year on the Lexington Campus.